

Claims:

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1. A stabilized monomer composition, comprising:

at least one ethylenically unsaturated monomer;

N,N-diethylhydroxylamine; and

5 N-nitroso-N-phenylhydroxylamine or its salt;

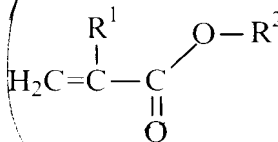
wherein a weight ratio of N,N-diethylhydroxylamine to N-nitroso-N-phenylhydroxylamine or its salt is from 1:1 to 10:1.

2. The composition according to Claim 1, wherein a concentration of N,N-diethylhydroxylamine is 10 to 500 ppm based on the total weight of said stabilized monomer composition; and

10 wherein a concentration of N-nitroso-N-phenylhydroxylamine or its salt is 10-500 ppm based on the total weight of said stabilized monomer composition.

3. The composition according to Claim 1, wherein said ethylenically unsaturated monomer is selected from the group consisting of a vinyl ester, a (meth)acrylic acid, a (meth)acrylic acid ester, a (meth)acrylic acid amide, a derivative of (meth)acrylic acid, a vinyl chloride, a vinylidene chloride, a vinyl acetate, a styrene, a styrene substituted with an alkyl group in the side chain, a styrene substituted with an alkyl group at the ring, a halogenated styrene, a vinyl ether, a isopropenyl ether, a maleic acid derivative, diene and mixtures thereof.

20 4. The composition according to Claim 3, wherein said derivative of (meth)acrylic acid is represented by Formula (I):



wherein

R¹ is hydrogen or a methyl group;

25 R² is a hydrogen, an aryl group, an aryl group containing hetero atoms, a saturated or unsaturated straight-chain, branched or cyclic alkyl group with up to 30 carbon atoms, or a saturated or unsaturated straight-chain, branched or cyclic alkyl group with up to 30 carbon atoms and containing hetero atoms.

5. The composition according to Claim 3, wherein said (meth)acrylic acid ester is a methyl (meth)acrylate, an ethyl (meth)acrylate, a propyl (meth)acrylate, an isopropyl (meth)acrylate, a n-butyl (meth)acrylate, an isobornyl (meth)acrylate, a hydroxyalkyl (meth)acrylate, an aminoalkyl (meth)acrylate or mixtures thereof.

6. The composition according to Claim 3, wherein said hydroxyalkyl (meth)acrylate is selected from the group consisting of 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, 3-hydroxypropyl (meth)acrylate, 3,4-dihydroxybutyl (meth)acrylate and mixtures thereof.

7. The composition according to Claim 3, wherein said (meth)acrylic acid amide is N,N-dimethylaminopropyl methacrylamide (DMAPMA), N,N-dimethylaminoethyl methacrylamide (DMAEMA) or a mixture thereof.

8. The composition according to Claim 3, wherein said styrene substituted within an alkyl group in the side chain is α -methylstyrene, α -ethylstyrene or mixtures thereof.

9. The composition according to Claim 3, wherein said styrene substituted with an alkyl group at the ring is vinyltoluene, p-methylstyrene or mixtures thereof.

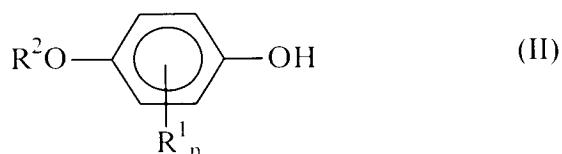
10. The composition according to Claim 3, wherein said halogenated styrene is selected from the group consisting of monochlorostyrene, dichlorostyrene, tribromostyrene, tetrabromostyrene and mixtures thereof.

11. The composition according to Claim 3, wherein said maleic acid derivative is selected from the group consisting of maleic anhydride, methylmaleic anhydride, maleimide, methylmaleimide and mixtures thereof.

12. The composition according to Claim 1, wherein said salt of N-nitroso-N-phenylhydroxylamine is an ammonium salt, an aluminum salt, a copper salt, a lithium salt, a sodium salt, a potassium salt, or a rubidium salt.

13. The composition according to Claim 1, further comprising an inhibitor and/or an antioxidant.

14. The composition according to Claim 13, wherein said inhibitor is a dihydroxybenzene of Formula (II):

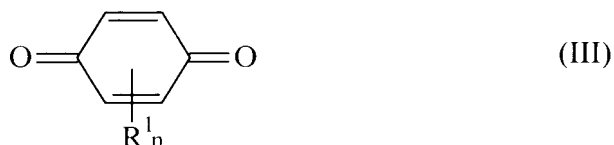


wherein R^1 is a straight-chain or branched alkyl group with one to eight carbon atoms, halogen or aryl;

n is an integer ranging from one to four; and

5 R^2 is hydrogen, a straight-chain or branched alkyl group with one to eight carbon atoms or aryl.

15. The composition according to Claim 13, wherein said inhibitor is a 1,4 benzoquinone of Formula (III):

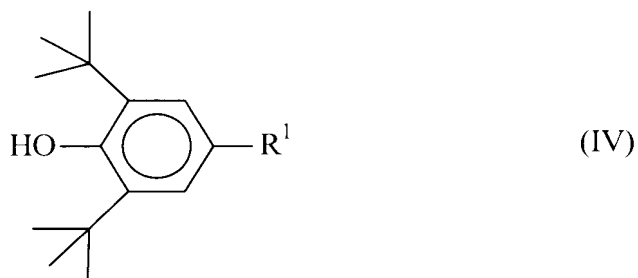


where

10 R^1 is a straight-chain or branched alkyl group with one to eight carbon atoms, halogen or aryl; and

n is an integer ranging from one to four.

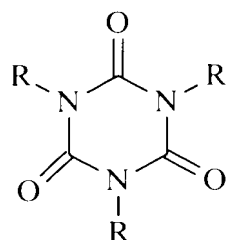
16. The composition according to Claim 13, wherein said inhibitor is a phenol of Formula (IV):



wherein

15 R^1 is a straight-chain or branched alkyl group with one to eight carbon atoms, aryl, aralkyl, a propionic acid ester group with a monohydric to tetrahydric alcohol optionally containing hetero atoms.

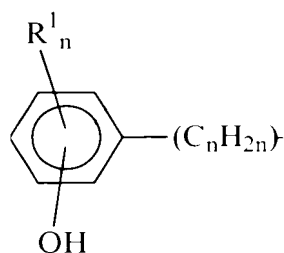
17. The composition according to Claim 13, wherein said inhibitor is a triazine derivative of Formula (V):



(V)

wherein

R = compound of Formula (VI)



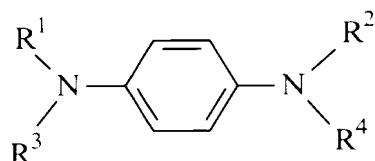
(VI)

wherein

$R^1 = C_nH_{2n+1}$; and

$n = 1$ or 2 .

18. The composition according to Claim 13, wherein said inhibitor is a



(VII),

p-phenylenediamine of Formula (VII):

wherein

R^1 , R^2 , R^3 and R^4 independently are hydrogen or alkyl, aryl, alkaryl, aralkyl groups, each with up to 40 carbon atoms.

19. The composition according to Claim 18, wherein said phenylenediamine is selected from the group consisting of p-phenylenediamine, N-Phenyl-N'-alkyl-p-phenylene diamine, N-phenyl-N',N'-dialkyl-p-phenylenediamine, N,N-dialkyl-p-phenylenediamine,

N,N'-dialkyl-p-phenylenediamine, N,N'-diaryl-phenylenediamine and N,N,N'-trialkyl-p-phenylenediamine

20. The composition according to Claim 13, wherein said inhibitor is a phenazine dye selected from the group consisting of induline and nigrosine.

21. The composition according to Claim 13, wherein said inhibitor has a concentration of 0.01 to 0.5% by weight based on the total weight of said composition.

22. The composition according to Claim 1, further comprising a solvent.

23. The composition according to Claim 22, wherein said solvent is selected from the group consisting of benzene, toluene, n-hexane, cyclohexane, methyl isobutyl ketone, methyl ethyl ketone and mixtures thereof.

24. The composition according to Claim 1, further comprising an adjuvant.

25. The composition according to Claim 24, wherein said adjuvant is selected from the group consisting of an anti-binding agent, an antistatic, an antioxidant, a biostabilizer, a chemical propellant, a mold-release agent, a flame retardant, a lubricant, a dye, a casting improvement agent, a filler, a slip additive, an adhesion promoter, a catalyst, a photostabilizer, an optical brightener, an organic phosphorus compound, an oil, a pigment, an impact toughness improver, a reinforcing agent, a reinforcing fiber, an anti-weathering agent, a plasticizer and mixtures thereof.

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26. A process for synthesis of a stabilized monomer composition, comprising:
mixing at least one ethylenically unsaturated monomer, N,N-diethylhydroxylamine and N-nitroso-N-phenylhydroxylamine or its salt;
wherein a weight ratio of N,N-diethylhydroxylamine to N-nitroso-N-phenylhydroxylamine or its salt is from 1:1 to 10:1.

27. The process according to Claim 26, further comprising adding an inhibitor and/or antioxidant.

28. The process according to Claim 26, further comprising adding a solvent.

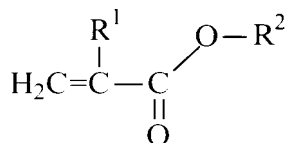
29. The process of Claim 26, further comprising adding an adjuvant.

30. The process according to Claim 26, wherein a concentration of N,N-diethylhydroxylamine is 10 to 500 ppm based on the total weight of said stabilized monomer composition; and

wherein a concentration of N-nitroso-N-phenylhydroxylamine or its salt is 10-500 ppm based on the total weight of said stabilized monomer composition.

31. The process according to Claim 26, wherein said ethylenically unsaturated monomer is selected from the group consisting of a vinyl ester, a (meth)acrylic acid, a (meth)acrylic acid ester, a (meth)acrylic acid amide, a derivative of (meth)acrylic acid, a vinyl chloride, a vinylidene chloride, a vinyl acetate, a styrene, a styrene substituted with an alkyl group in the side chain, a styrene substituted with an alkyl group at the ring, a halogenated styrene, a vinyl ether, a isopropenyl ether, a maleic acid derivative, diene and mixtures thereof.

32. The process according to Claim 26, wherein said derivative of (meth)acrylic acid is represented by Formula (I):



10 wherein

R^1 is hydrogen or a methyl group;

R^2 is a hydrogen, an aryl group, an aryl group containing hetero atoms, a saturated or unsaturated straight-chain, branched or cyclic alkyl group with up to 30 carbon atoms, or a saturated or unsaturated straight-chain, branched or cyclic alkyl group with up to 30 carbon atoms and containing hetero atoms.

33. The process according to Claim 26, wherein said (meth)acrylic acid ester is a methyl (meth)acrylate, an ethyl (meth)acrylate, a propyl (meth)acrylate, an isopropyl (meth)acrylate, a n-butyl (meth)acrylate, an isobornyl (meth)acrylate, a hydroxyalkyl (meth)acrylate, an aminoalkyl (meth)acrylate or mixtures thereof.

34. The process according to Claim 26, wherein said hydroxyalkyl (meth)acrylate is selected from the group consisting of 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, 3-hydroxypropyl (meth)acrylate, 3,4-dihydroxybutyl (meth)acrylate and mixtures thereof.

35. The process according to Claim 26, wherein said (meth)acrylic acid amide is N,N-dimethylaminopropyl methacrylamide (DMPMA), N,N-dimethylaminoethyl methacrylamide (DMAEMA) or a mixture thereof.

36. The process according to Claim 26, wherein said styrene substituted within an alkyl group in the side chain is α -methylstyrene, α -ethylstyrene or mixtures thereof.

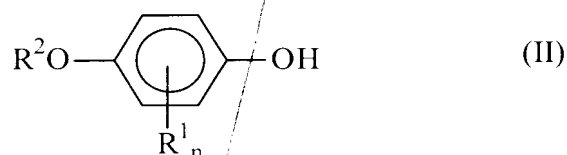
37. The process according to Claim 26, wherein said styrene substituted with an alkyl group at the ring is vinyltoluene, p-methylstyrene or mixtures thereof.

38. The process according to Claim 26, wherein said halogenated styrene is selected from the group consisting of monochlorostyrene, dichlorostyrene, tribromostyrene, tetrabromostyrene and mixtures thereof.

39. The process according to Claim 26, wherein said maleic acid derivative is selected from the group consisting of maleic anhydride, methylmaleic anhydride, maleimide, methylmaleimide and mixtures thereof.

40. The process according to Claim 26, wherein said salt of N-nitroso-N-phenylhydroxyamine is an ammonium salt, an aluminum salt, a copper salt, a lithium salt, a sodium salt, a potassium salt, or a rubidium salt.

41. The process according to Claim 27, wherein said inhibitor is a dihydroxybenzene of Formula (II):

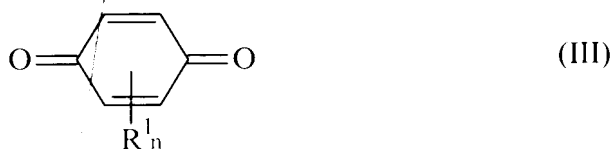


wherein R^1 is a straight-chain or branched alkyl group with one to eight carbon atoms, halogen or aryl;

n is an integer ranging from one to four; and

R^2 is hydrogen, a straight-chain or branched alkyl group with one to eight carbon atoms or aryl.

42. The process according to Claim 27, wherein said inhibitor is a 1,4 benzoquinone of Formula (III):



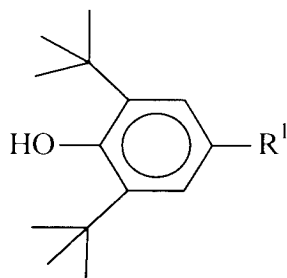
where

R^1 is a straight-chain or branched alkyl group with one to eight carbon atoms, halogen or aryl; and

n is an integer ranging from one to four.

43. The process according to Claim 27, wherein said inhibitor is a phenol of Formula

(IV):

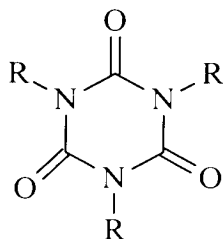


(IV)

wherein

5 R¹ is a straight-chain or branched alkyl group with one to eight carbon atoms, aryl, aralkyl, a propionic acid ester group with a monohydric to tetrahydric alcohol optionally containing hetero atoms.

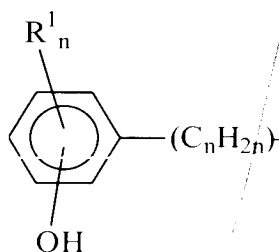
44. The process according to Claim 27, wherein said inhibitor is a triazine derivative of Formula (V):



(V)

10 wherein

R = compound of Formula (VI)



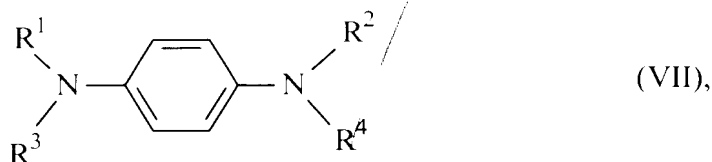
(VI)

wherein

R¹ = CₙH₂ₙ₊₁; and

n = 1 or 2.

45. The process according to Claim 27, wherein said inhibitor is a phenylenediamine of Formula (VII):



wherein

R^1 , R^2 , R^3 and R^4 independently are hydrogen or alkyl, aryl, alkaryl, aralkyl groups, each with up to 40 carbon atoms.

46. The process according to Claim 45, wherein said phenylenediamine is selected from the group consisting of p-phenylenediamine, N-Phenyl-N'-alkyl-p-phenylene diamine, N-phenyl-N',N'-dialkyl-p-phenylenediamine, N,N-dialkyl-p-phenylenediamine, N,N'-dialkyl-p-phenylenediamine, N,N'-diaryl-phenylenediamine and N,N,N'-trialkyl-p-phenylenediamine.

47. The process according to Claim 27, wherein said inhibitor is a phenazine dye selected from the group consisting of induline and nigrosine.

48. The process according to Claim 27, wherein said inhibitor has a concentration of 0.01 to 0.5% by weight based on the total weight of said composition.

49. The process according to Claim 28, wherein said solvent is selected from the group consisting of benzene, toluene, n-hexane, cyclohexane, methyl isobutyl ketone, methyl ethyl ketone and mixtures thereof.

50. The process according to Claim 29, wherein said adjuvant is selected from the group consisting of an anti-binding agent, an antistatic, an antioxidant, a biostabilizer, a chemical propellant, a mold-release agent, a flame retardant, a lubricant, a dye, a casting improvement agent, a filler, a slip additive, an adhesion promoter, a catalyst, a photostabilizer, an optical brightener, an organic phosphorus compound, an oil, a pigment, an impact toughness improver, a reinforcing agent, a reinforcing fiber, an anti-weathering agent, a plasticizer and mixtures thereof.

51. A process for synthesis of a 2-hydroxyalkyl (meth)acrylate, comprising: reacting an oxirane compound with (meth)acrylic acid in the presence of a catalyst;

adding at least one inhibitor;

adding an aqueous solution of N,N-diethylhydroxylamine and N-nitroso-N-phenylhydroxylamine or its salt, thereby providing a mixture; and
distilling said mixture.

5 52. The process according to Claim 51, wherein a weight ratio of N,N-diethylhydroxylamine to N-nitroso-N-phenylhydroxylamine or its salt is from 1:1 to 10:1.

53. The process according to Claim 51, wherein a concentration of N,N-diethylhydroxylamine is 10 to 500 ppm based on the total weight of said stabilized monomer composition; and

10 wherein a concentration of N-nitroso-N-phenylhydroxylamine or its salt is 10-500 ppm based on the total weight of said stabilized monomer composition.

54. The process according to Claim 51, wherein said oxirane is selected from the group consisting of ethylene oxide, propylene oxide, 1,2-butylene oxide, 2,3-butylene oxide, cyclohexene oxide, styrene oxide, 1,2,3,4-diepoxybutane, 1,2,5,6 diepoxyhexane,
15 epichlorhydrin, a glycidyl ester and mixtures thereof.

• 55. The process according to Claim 51, wherein said catalyst is selected from the group consisting of a chromium (III) carboxylate, a chromium (III) alkoxide, an iron (III) methacrylate and mixtures thereof.

• 56. The process according to Claim 51, wherein said process proceeds at a
20 temperature of 15 to 90°C.

57. The process according to Claim 51, wherein said process proceeds at a pressure of 1 to 5 bar.

58. A method of purifying a 2-hydroxyalkyl (meth)acrylate, comprising:
adding at least one inhibitor to said 2-hydroxyalkyl (meth)acrylate;
25 adding an aqueous solution of N,N-diethylhydroxylamine and N-nitroso-N-phenylhydroxylamine or its salt, thereby providing a mixture; and
distilling said mixture.

59. The method according to Claim 58, wherein said hydroxylalkyl (meth)acrylate is 2-hydroxyethyl acrylate.

30 60. The method according to Claim 58, wherein a temperature of said distilling is 130 °C.

61. The method according to Claim 58, wherein a pressure of said distilling is 10 to 12 mbar.

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